Another point that should be mentioned is that if during the experiments defect concentration and hence resistivity are functions of position in the foil, then the resistance measured is

$$R = \frac{L}{A} \quad \frac{1}{<\sigma>}$$

where $<\sigma>$ is the mean value of the electrical conductivity over the foil thickness and $<\sigma> = <\frac{1}{\rho}> \neq \frac{1}{<\rho>}$.

H. Effect of Anneal on Shock Resistivity

Part of the experimental program was to determine the effect of high-temperature annealing on the resistivity change of cold-rolled silver foil in response to shock waves. Two shots were done on unannealed MRC foil. Isothermal resistivity data for the unannealed foil are slightly higher than for annealed (Fig. 11). More data would be necessary to know if this deviation is real.

Since most point defects in silver will annihilate or diffuse to the surfaces at room temperature (Dawson, 1965), the main effect of high temperature anneal is removal of dislocations from the cold-rolled foil; impurity clustering could also take place. Density of dislocations removed by anneal was calculated from liquid helium temperature resistance measurements on MRC foil before and after anneal. Using published dislocation resistivity in silver (Basinski, Dugdale, and Howie, 1963)

$$\Delta\rho_D = (1.9 \times 10^{-13}\ \mu\Omega\text{cm}^3)\ \Lambda$$

(Λ is dislocation line density), the result was 2×10^{10} cm/cm^3.

This dislocation density is within reason for cold-rolled metals; $5 \times 10^{11}/cm^2$ is quoted by Hull (1965) for heavily cold-rolled metal.

Previous shock work shows a variety of effects of initial dislocation density on shock response. Work on single crystal copper shows that 3.5% prestrain reduces the initial elastic stress jump after 5 millimeters of shock propagation to near zero; a ramping precursor wave follows the jump (Jones and Mote, 1969). (The prestraining increased dislocation density to $10^9/cm^2$ from $10^6/cm^2$.) This ramping from zero stress is probably indicative of visco-plastic behavior (Gilman, 1968). Shock hardening of annealed nickel, on the other hand, was independent of prestrain, prestrained by cold rolling to as much as 80% reduction in thickness (Rose, Berger, and Inman, 1967). Also, a change of an order of magnitude in initial dislocation density did not significantly affect precursor decay in lithium fluoride (Asay et al., 1972).

Within the context of the model developed in Sec. IV.G, the lithium fluoride results would imply about the same defect concentration for annealed and unannealed silver. From the standpoint of the jog model discussed in Sec. IV.E, one might expect greater initial forest dislocation density in unannealed foil to result in more jogs and hence more defects. This is one possible explanation of the trend of the data.

I. Discussion of Resistivity Time Dependence

In this section possible physical interpretations of the structure of the voltage-time profiles are discussed.